

Example Demonstrating How NCSP Capabilities Used to Address Technical Issues in DOE Complex

Recent NCSP Work involving ²³³U

The Five Elements of the US NCSP [Nuclear Data (**ND**), Analytical Methods (**AM**), Integral Experiments (**IE**), Information Preservation & Dissemination (**IP&D**), and Training and Education (**T&E**)] provide the requisite infrastructure needed to support nuclear criticality safety operations throughout the DOE Complex. As an example, recent work involving ²³³U demonstrates how the comprehensive capabilities of the NCSP have been brought to bear on technical issues of national importance to the DOE Complex.

²³³U Technical Issue:

Prior to the establishment of the NCSP, nuclear criticality safety (NCS) analysis capabilities were hindered for fissile systems involving ²³³U thereby adversely affecting safety basis analyses for ²³³U systems. The analysis issues were demonstrated by poor performance of modern radiation transport tools (**AM**) for modeling ²³³U critical benchmark experiments (**IE** and **IP&D**), and the poor performance was traced to issues with the underlying ²³³U nuclear data (**ND**) available to the NCS radiation transport tools used in the Complex.



U-233 Trial Run



ORNL Storage Tubes

Comprehensive Solution provided by NCSP for Work Involving ²³³U:

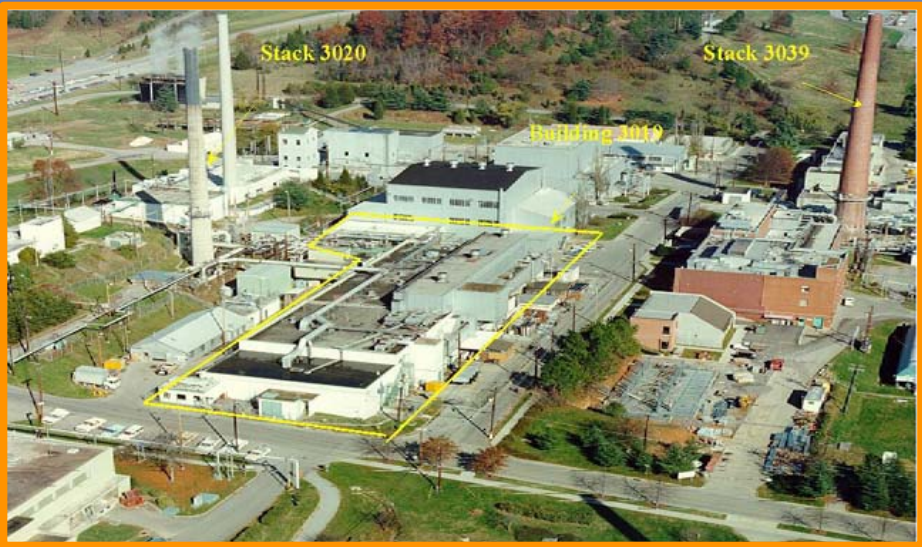
ND: The NCSP performed new ²³³U nuclear data measurements and subsequent cross-section analyses to provide a new ²³³U cross-section evaluation with uncertainty data. The improved ²³³U nuclear data evaluation is disseminated as part of the US Evaluated Nuclear Data File (ENDF) system that is distributed by the US National Nuclear Data Center (NNDC) with support from the NCSP.

AM and IP&D: The new ²³³U cross-section evaluation has resulted in improved radiation transport calculations of critical benchmark experiments documented in the International Criticality Safety Benchmark Evaluation Project (ICSBEP) handbook. The ICSBEP is developed and maintained by the NCSP.

AM: In concert with the **ND** work, the NCSP has developed modern state-of-the-art radiation transport software that NCS practitioners use to perform nuclear safety analyses for supporting safety basis documentation efforts. As part of the **AM** effort, the NCSP has developed sensitivity/uncertainty (S/U) analysis tools to quantify uncertainty and bias uncertainty for fissionable material systems thereby providing a rigorous, defensible safety basis analysis. For the ²³³U example case, the NCSP **AM** capabilities have been used to demonstrate how the S/U tools can be used to validate NCS analyses to support down-blending of the ²³³U inventory stored in the Radiochemical Development Facility at ORNL.

T&E: NCS practitioners receive training on the use of the NCSP-developed software tools through NCSP-supported code development efforts of MCNP and SCALE. For the ²³³U example case, the SCALE developers provided guidance and assistance to NCS practitioners in the use of the S/U tools to perform validation analyses for the ORNL Radiochemical Development Facility safety basis documentation efforts.

IE: As part of the ²³³U work effort, additional integral benchmark experiment needs have been identified for ²³³U systems, and new integral experiment requests have been submitted to the NCSP for design and execution of new ²³³U benchmark critical experiments. With the establishment of critical experiment capabilities at the Nevada National Security Site (NNSS) and availability of ²³³U material, the NCSP is working with the cognizant NCS end users to define new ²³³U benchmark experiments as needed to support DOE mission needs.



ORNL Building 3019



National Nuclear Security Administration's (NNSA)

Nuclear Criticality Safety Program (NCSP)
Mission and Objective

The Department of Energy (DOE) NCSP is chartered with maintaining the technical infrastructure necessary to ensure safe, efficient operations from a criticality safety perspective.

Nothing is more fundamental to operations with fissionable material than criticality safety. Ensuring that a criticality accident never happens again in a DOE facility is one key facet of the DOE mission supporting the national security and energy needs of the United States.



Nuclear Criticality Safety Program (NCSP)

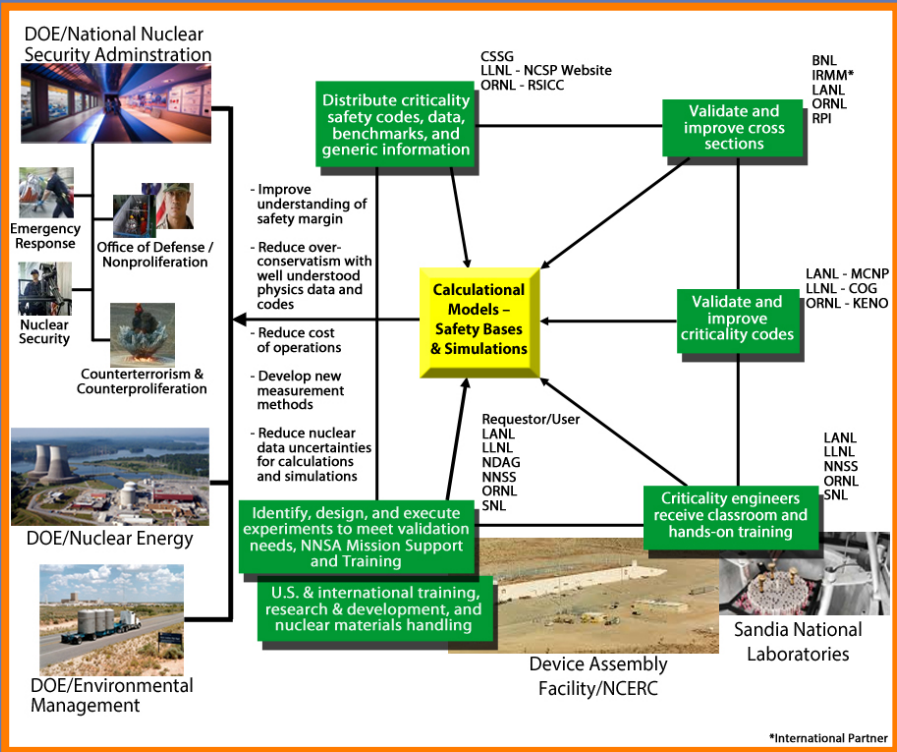
Mission and Objective

History:

Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 93-2 issued on March 23, 1993 addressed the need for a general-purpose critical experiment capability that will ensure safety in handling and storage of fissionable material. Subsequently, DNFSB Recommendation 97-2 issued on May 19, 1997 addressed the need for improved criticality safety practices and programs to alleviate potential adverse impacts on safety and productivity of DOE operations. Recommendation 97-2 encompassed the ongoing Department activities of Recommendation 93-2 while broadening the scope to address important crosscutting safety activities needed to ensure nuclear criticality safety throughout the Complex. The DOE Implementation plan for Board Recommendations 93-2 and 97-2 resulted in the establishment of the NCSP, and the ongoing criticality safety activities of the DOE have been performed under the NCSP that has been established per Board Recommendation 97-2. To implement Recommendation 97-2 in an integrated fashion, DOE took steps to ensure stable funding for the important crosscutting safety activities required by the recommendation. Further, effective implementation of the 97-2 crosscutting criticality safety activities under the NCSP is important to the successful completion of other DOE programs, such as those programs which address Board Recommendations 97-1, 94-1, 94-4, and 95-2.

The NCSP is funded by the National Nuclear Security Administration (NNSA). They are supported by the Criticality Safety Support Group (CSSG) and the Nuclear Data Advisory Group (NDAG) regarding technical matters and by the Criticality Safety Coordinating Team (CSCT), consisting of Federal Criticality Safety Practitioners at the sites regarding DOE field criticality safety issues. Charters for the CSSG, NDAG, and the CSCT can be found on the NCSP website (<http://ncsp.llnl.gov/>), and these support groups perform the technical support functions for the NCSP described inside.

The Nuclear Criticality Safety Program Infrastructure Supports Safe and Efficient Fissionable Material Operations DOE-Wide



The Integrated Nuclear Criticality Safety Program

Nuclear Criticality Safety Program (NCSP) funded by the National Nuclear Security Administration (NNSA)

Program Overview:

The Mission and Vision for the NCSP provides the planning basis for the next five to ten years for all funding and initiatives undertaken by the NCSP in five broad technical program elements that support identified goals. The NCSP and its initiatives are executed annually in a series of updates to a rolling Five-Year Plan. It also defines the values and operating culture of the NCSP and facilitates development of a coherent, integrated implementation plan. The Five-Year Execution Plan has been the plan to achieve the five-year vision of the NCSP and is developed/updated with the advice and assistance of experts appointed by the NCSP Manager or working under charters approved by the NCSP manager. The five technical program elements are:

- **Analytical Methods Information**
- **Integral Experiments**
- **Training and Education**
- **Information Preservation and Dissemination**
- **Nuclear Data**

The **Analytical Methods (AM)** program element provides for the development and maintenance of state-of-the-art analytical capabilities for the processing of nuclear data from the Evaluated Nuclear Data File (ENDF) and the radiation transport analysis capabilities needed to perform nuclear criticality safety analyses.

The **Information Preservation and Dissemination (IP&D)** program element preserves primary documentation supporting criticality safety [e.g., benchmark critical experiments from the International Criticality Safety Benchmark Evaluation Project (ICSBEP)] and makes this information available for the benefit of the technical community including international partners (e.g., AWE, CEA and OECD) through the NCSP website (<http://ncsp.llnl.gov>).

The **Integral Experiments (IE)** program element maintains a fundamental capability for the DOE NCSP to be able to perform critical, subcritical, and fundamental physics measurements, to address specific-site needs on a prioritized basis, and this program element also supports maintaining a fundamental nuclear materials handling capability, which enables hands-on NCS training programs and various other programs for the DOE NCSP and other Government Agencies.

The **Nuclear Data (ND)** program element includes the measurement, evaluation, testing, and publication of neutron cross-section data for nuclides of high importance to nuclear criticality safety analyses.

The **Training and Education (T&E)** program element identifies, develops, and facilitates training needs and educational resources (including hands-on training with fissionable material systems) in areas where no suitable alternative exists, and the primary purpose of the T&E element is to maintain and enhance the technical abilities and knowledge of those who impact (Criticality Safety Engineers, Criticality Safety Officers, and managers) or are impacted directly by (operators and process supervisors) the practice of criticality safety.

NCSP Support Groups: CSSG

The Criticality Safety Support Group was formed in response to DNFSB Recommendation 97-2 Sub-recommendation 8 and is composed of persons from DOE staff and contractors having collective knowledge in broad spectrum of nuclear criticality technology and safety areas. CSSG Work Instructions are issued from the NCSP Manager and are available on the NCSP Website. The primary function of the CSSG is to provide operational and technical expertise to the DOE through the NCSP Manager. The CSSG provides advice and technical support to help meet the criticality safety needs of DOE missions, including stockpile stewardship, materials stabilization, transportation, storage, facilities decommissioning, and waste disposal. The CSSG also makes recommendations for the implementation and execution of the coherent, efficient NCSP administered for the DOE by the NNSA.

NDAG

The Nuclear Data Advisory Group, through making recommendations to the NCSP Manager, enhances the coordination of the NCSP Nuclear Data Element work program with current and future DOE needs and promotes the integration of this work program with the other elements of the NCSP.

CSCT

The DOE Criticality Safety Coordinating Team (CSCT) is the federal operational branch counterpart to the CSSG that plays a key role in ensuring DOE's criticality safety programs stay within the framework of Integrated Safety Management Principles and performs key, federal technical support functions needed for consistent implementation of NCS throughout the Complex.

Annual NCSP Execution:

At the start of each fiscal year, the NCSP issues a calendar for the year that provides key task completion dates and milestones to ensure effective budget cycle planning and task execution of the NCSP. The NCSP calendar provides the timeline for completing programmatic tasks along with budget planning and review tasks to ensure the budget is managed effectively and prioritized tasks are completed to address technical issues in the Complex. Furthermore, the NCSP calendar provides the budget planning schedule that begins with the request for new task proposals for the next fiscal year with subsequent headquarter task review and prioritization resulting in the publication of the Five Year Execution plan to initiate work tasks for the next fiscal year.

NNSA Nuclear Criticality Safety Program

